UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

P. O. Box 648
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From: Clyde W. Graham, Assistant State Conservationist, SCS, Temple

Subject: TECHNICAL DATA - Sedimentation

Enclosed are two copies of a paper entitled, "Factors Influencing Sediment Delivery Ratios in the Blackland Prairie Land Resource Area," prepared by personnel of the E&WP Unit staff.

This guide is a revision of "Suggested Criteria for Estimating Gross Sheet Erosion and Sediment Delivery Rates for the Blackland Problem Area in Soil Conservation," distributed by the E&WP Unit office in February, 1953.

The guide is intended primarily for use by planning party geologists in watershed work plan development.

Enclosures (2)

cc with attachment:
J. M. Cunningham, S/O
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FACTORS INFLUENCING SEDIMENT DELIVERY RATIOS

IN THE

BLACKLAND PRAIRIE LAND RESOURCE AREA

INTRODUCTION

This paper presents the results of a study designed to isolate watershed variables that are closely associated mathematically as well as rationally with the sediment delivery ratios of a group of small watersheds in the Blackland Prairie Land Resource Area. In addition to determining variables that are indicators of sediment delivery ratio, the characteristics of the most significant independent variable was studied in terms of its relationship to watershed conditions believed to promote or inhibit the downstream delivery of erosional material.

A sediment delivery ratio study, involving a limited number of samples, in the Blackland Prairie Land Resource Area was made by Maner and Barnes[1/] in 1953. The current investigation utilized the original data as well as sediment yield and erosion data for other reservoirs not previously reported.

1/ "Suggested Criteria for Estimating Gross Sheet Erosion and Sediment Delivery Rates for the Blackland Prairie Problem Area in Soil Conservation" - Sam B. Maner and Leland H. Barnes, U. S. Dept. of Agriculture, SCS, Fort Worth, Texas, 1953

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Sediment yield is dependent upon gross erosion from a watershed and the transport of the eroded material to a given point of measurement. In almost all watersheds the sediment delivered to any point during any period will be less than 100 percent of the gross erosion occurring above that point. Since only a part of the material set in motion by erosion processes is moved out of a watershed, the gross erosion figure must be adjusted downward to arrive at the sediment yield. This adjustment factor is the ratio of sediment yield to gross erosion and is termed the sediment delivery ratio. It is dependent upon several interrelated physical, hydrologic, hydraulic and other watershed characteristics. If significant relationships between sediment delivery ratio and certain watershed characteristics can be established for a group of watersheds in a relatively homogeneous area, it is then possible to develop a procedure for making sound estimates of expected sediment yield from gross erosion data and the sediment delivery ratio characteristics of other watersheds within this area.

Reliable basic data on sediment yield is of major importance to the Soil Conservation Service in the development and application of the watershed protection and flood prevention phase of the overall program, which is designed to reduce upstream floodwater and sediment damages.

Under this program the significance of sediment yield is pinpointed when considering such things as (1) floodwater retarding structure design, in terms of sediment storage requirements for a given period; (2) the intensity of land treatment required to reduce soil erosion to a given level; (3) the location and extent of sediment sources so that effective

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control measures can be planned and installed; and (4) watershed protection program evaluations, etc.

Sediment Yield and Gross Erosion

Fourteen watersheds on which annual sediment yield and gross erosion data are available were selected for use in developing the sediment delivery ratios used in this study. Sediment yield values for the sample watersheds were established by adjusting measured reservoir sediment deposition for reservoir trap efficiency.

Annual gross erosion estimates were made separately, computing the amount derived from sheet, channel and gully erosion. The average annual quantity of material derived from channel and gully erosion was determined by estimating the annual increase in void area (expressed as volume) for all channels and gullies. Annual sheet erosion rates were computed by the Musgrave method[2/] in a manner previously described by Barnes and Maner[3/]. A copy of that procedure is included as an appendix to this paper.

Watershed Physical Surveys

Detailed studies were made of the watershed above each reservoir to obtain quantitative data on physical characteristics which were thought to influence downstream delivery of eroded material. The variables studied were: (1) watershed area, (2) channel density, (3) main stem

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2/ "The quantitative evaluation of factors in water erosion, a first approximation", G. W. Musgrave, Journal of Soil and Water Conservation, 2, 133-170, 1947.

3/ "A method for estimating the rate of soil loss by sheet erosion from individual fields or farms under various types of land treatment", Leland H. Barnes and Sam B. Maner, U. S. Dept. of Agriculture, Soil Conservation Service, Fort Worth, Texas, 12 pp., 1953.

channel length, (4) relief-length ratio and (5) watershed relief and various combinations of these variables. Values for the various variables used in the study are shown in table 1.

Analysis of Data

Regression-type analyses were used to establish mathematical relationships between the dependent variable, sediment delivery ratio, and various independent variables selected for testing in this study.

Scatter-diagram type plottings of sediment delivery ratio with the various independent variables indicated a definite departure from linearity in most cases. Similar plottings on logarithmic paper indicated the relationship between sediment delivery ratio and various physical characteristics of the sample watersheds to be exponential in form. Therefore, the numerical values of all variables were transformed to logarithms for use in the analyses.

A comparison of the various log-log plottings indicated watershed area to be a slightly better indicator of sediment delivery ratio than the other variables tested. A non-linear correlation between watershed area and sediment delivery ratio was computed to obtain the regression equation:

$$\text{Log DR} = 1.87680 - 0.14191 \text{ Log } 10A \quad (1)$$

where

DR = Estimated sediment delivery ratio in percent of annual erosion

A = Sediment contributing area in square miles.

Table 1 - Basic Data Used in Sediment Delivery Ratio Study

Name of Reservoir	Watershed Area 1/	Delivery Ratio	Relief	Relief/Length Ratio	Channel Length (Main Stem)	Channel Length (All Channels)	Channel Density
	(Sq.Mi.)		(Foot)		(Foot)	(Mile)	(Mi./Sq.Mi.)
Magnolia Lake	0.43	67	75	0.01420	5,281	1.8	4.18
Rogers Lake	0.51	61	100	0.01262	7,920	1.5	2.94
Burke Neck Lake	0.54	51	46	0.00639	7,200	1.6	2.96
Dawson City Lake	1.07	53	60	0.00789	7,600	3.4	3.18
Lower Beaton Lake	1.26	54	77	0.00898	8,571	2.9	2.30
Floodwater Retarding Structure No. 12 - Honey Creek	1.26	53	85	0.00805	10,560	3.0	2.38
Lake Gibbons	1.26	52	83	0.00898	9,240	4.0	3.17
Floodwater Retarding Structure No. 11 - Honey Creek	1.93	52	71	0.00806	8,810	5.0	2.59
Ennis City Lake	2.89	47	78	0.00591	13,200	5.5	1.90
Floodwater Retarding Structure No. 4 - Cow Bayou	5.20	41	150	0.00810	18,500	9.0	1.73
Lake Halbert	8.31	42	123	0.00388	31,680	14.1	1.70
Terrell City Lake	8.71	38	85	0.00310	27,456	12.0	1.38
Lake Crook	49.60	35	163	0.00247	66,000	48.0	0.97
White Rock Lake	97.40	26	298	0.00230	129,560	60.0	0.62

1/ Excluding the reservoir area.

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The standard error of estimate of this equation is ± 0.03007 log units and the coefficient of curvilinear correlation is 0.96, which expresses a 92 percent account of the variations between watersheds in sediment delivery ratios. The empirical relationship of sediment delivery ratio to watershed area is presented in the form of the delivery ratio curve in Figure 1.

Subsequent testing of other independent variables, individually and in association with each other, failed to improve equation (1). However, channel density (ft. of channel per square mile of watershed), relief-length ratio (height of watershed in feet divided by length of watershed in feet with length measured essentially parallel to the main stem channel), and main stem channel length (in feet) were found to be significant indicators of watershed sediment delivery ratio.

The results of four correlations in terms of correlation coefficient, proportion of explained variation in delivery ratios attributable to each independent variable or combinations of variables, and the relative importance of each correlation in explaining variations in sediment delivery ratios are presented in Table 2.

Table 2 - Results of Correlation Analyses; Dependent Variable, Sediment Delivery Ratio

Independent Variables	Correlation Coefficient R	Proportion of Explained Variation R^2	Explained Variation Index
Watershed Area (sq.mi.)	0.96	92	1.00
Channel Density (mi./sq.mi.)	0.95	90	0.98
Main Stem Channel Length (ft.)	0.94	88	0.95
Relief-Length Ratio	0.92	84	0.91

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The standard error of estimate of this equation is ± [illegible] log units and the coefficient of curvilinear correlation is [illegible] which expresses a 92 percent account of the variations between watershed [illegible] sediment delivery ratios. The empirical relationship of sediment delivery ratio to watershed area is presented in the form of the delivery ratio curve in Figure 1.

Subsequent testing of other independent variables, both singly and in association with each other, failed to improve estimates. However, channel density (feet of channel per square mile of watershed), relief-length ratio (height of watershed in feet divided by length of watershed in feet with length measured essentially parallel to the main drainage channel), and main stem channel length [illegible] correlation with sediment delivery ratio.

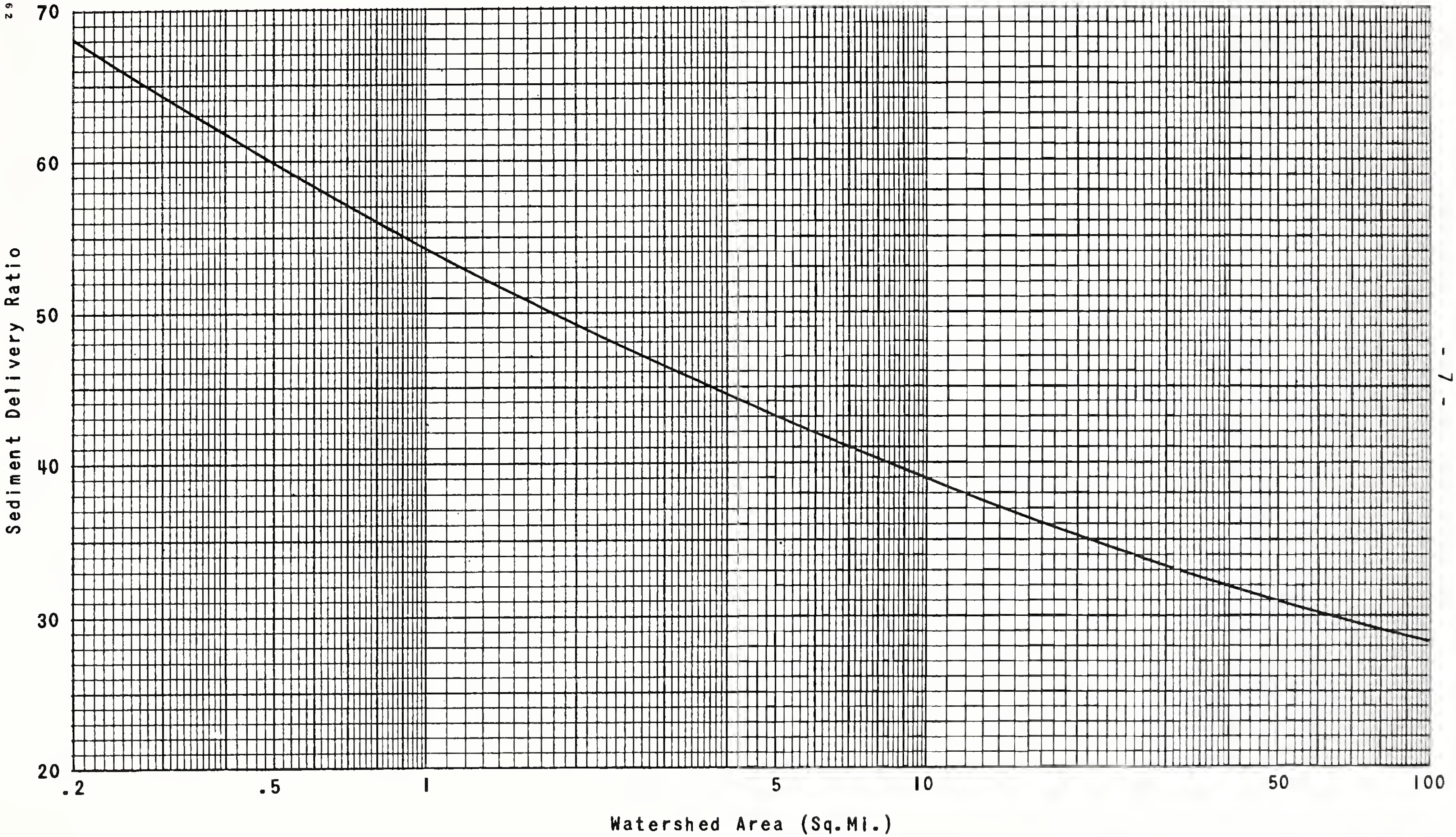
The results of these correlations [illegible]

[illegible]

Figure I

SEDIMENT DELIVERY RATIO CURVE

BLACKLAND PRAIRIE LAND RESOURCE AREA



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Characteristics of Watershed Area Variable

A study of the characteristics of the size of watershed variable, when used in a regression analysis with sediment delivery ratio, showed that the net influence of several watershed factors are represented in the derived equation for estimating sediment delivery ratio. For example, plottings on log-log revealed that watershed size is significantly related to the following measurable characteristics of the sample watersheds:

(1) Length of all channels: In this relatively homogeneous area total channel length was found to increase with an increase in size of watershed; (2) Channel density: In contrast to the large watersheds, small watersheds are found to have more linear feet of channels per unit of area; (3) Main stem channel length: The length of a main stem channel is directly related to the area of the watershed it serves; (4) Relief: Total relief increases with increasing watershed size; (5) Relief-length ratio: Large watersheds usually have lower relief-length ratio values than smaller watersheds in the same area; (6) Alluvial soils area: In contrast to small watersheds, larger watersheds have a greater proportion of their total area in alluvial soils, indicating an inverse relationship between watershed area and downstream delivery of erosional material.

Conclusion

Sediment delivery ratio in the Blackland Prairie Land Resource Area is a function of several watershed characteristics. These are related to and apparently are adequately expressed by the watershed area variable.

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Appendix

ANNUAL GROSS EROSION

In estimating annual gross erosion the quantity of material derived from sheet erosion and the quantity contributed by channel, gully and/or streambank erosion must be computed separately.

Sheet Erosion

Sheet erosion is computed by the Musgrave equation:

$$E = FRS^{1.35} \quad L^{0.35} \quad P_{30}^{1.75}$$

where

E = Sheet erosion, acre-inches per year 1/

F = Soil factor, basic erosion rate in inches per year for each soil unit

R = Cover factor

S = Land slope in percent

L = Length of land slope in feet

P_{30} = Maximum 30-minute intensity, 2-year frequency rainfall, in inches.

To illustrate this method for computing annual sheet erosion, step by step tabulations and computations for a sample watershed are shown in table 5.

1/ E may be expressed in inches, feet or tons per acre depending on the unit of measure used for item F.

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Assuming that a soil unit map of the watershed is available, the first step in computing annual sheet erosion is to delineate and/or measure the area (acres) of each type of cultivated crop (small grains, row crops, etc.) and/or range condition class by soil unit, land slope in percent, length of slope in feet and type of treatment (such as terraced areas). Total all like delineations or measurements and record under basic data on a form such as table 5.

From table 1 select the basic erosion rate[1/] by soil units and record it in column 10. From tables 2, 3, or 4 and figure 1 select the sheet erosion adjustment factor for each separate tabulation under Basic Data and record in the appropriate column under Sheet Erosion Computations. The product of columns 10, 11, 12, and 13 is the average annual sheet erosion rate in inches (column 14). Column 14 is converted to acre-feet to obtain column 15.

All data used in table 5 are self explanatory except slope length. Slope length may be measured on aerial photographs or on the ground. On terraced fields, slope length is the average distance between terraces. For all other areas slope length is the total uninterrupted distance overland flow must travel, on a given grade, before reaching a well defined drainageway. Fence rows across slopes are considered as slope length breaks. In some cases slope length may not be confined entirely to the field or farm involved but may include the distance across a neighboring area.

1/ Basic erosion rate values in table 1 are based on 10 percent land slope, 72 ft. slope length, 100 percent row crop cover cultivated downhill, and a 30-minute, 2-year frequency rainfall of 1.375". Tables 2, 3, and 4 are used to adjust for any change from the above conditions.

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Assuming that a soil unit map of the watershed is available, the first step in computing annual sheet erosion is to delineate and/or measure the area (acres) of each type of cultivated crop (small grains, row crops, etc.) and/or range condition class by soil unit, land slope in percent, length of slope in feet and type of treatment (contoured, terraced areas). Total all like delineations or measurements and record and tabulate on a form such as table 5.

From table 1 select the basic erosion rate[1] by soil unit [illegible] (column [illegible]). From tables 2, 3, or 4 and figure 1 select the applicable erosion adjustment factor for each [illegible] condition [illegible] and record in the appropriate column under Sheet Erosion Computation [illegible]

[illegible]

Channel, Gully and/or Streambank Erosion

Annual erosion (in acre-feet) from these sources is computed from measurements made in the field and recorded on a form similar to table 6. In connection with column 4 of this table, annual rates of lateral or vertical cutting can be estimated by comparing aerial photographs of different dates, from cross-section resurveys, data from land operator or other local residents. To illustrate this procedure for computing annual streambank and gully erosion, the tabulations and computations for a sample watershed are shown on table 6.

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Table No. 1

Basic Erosion Rates by Soil Units*

Soil Unit	Annual Soil Loss Inches	Annual Soil Loss Feet	Soil Unit	Annual Soil Loss Inches	Annual Soil Loss Feet
1	.65	.054	12	.15	.013
1	.54	.045 1/	12x	.12	.010
2	.54	.045	13	.12	.010
2x	.41	.034	14	.29	.024
2xd	.08	.007	15	.12	.010
3	.65	.054	16	.65	.054
4	.54	.045	17	.54	.045
4H	.54	.045	18	.41	.034 6/
4x	.41	.034	18	.65	.054
5	.65	.054	19	.65	.054
5a	.65	.054	19a	.65	.054
6	.41	.034	20	.41	.034
6	.65	.054 2/ 3/	20d	.15	.013
6	.54	.045 4/ 5/ 6/	23	.41	.034
6d	.29	.024	24	.54	.045
7	.29	.024	24	.65	.054 9/
7	.41	.034 7/ 8/	24c	.08	.007
7	.65	.054 2/ 3/	24d	.41	.034
7d	.15	.013	25	.41	.034
7f	.15	.013	25	.65	.054 3/ 9/
7x	.15	.013	25c	.08	.007
7xd	.08	.007	25d	.08	.007
8	.41	.034	26	.08	.007
9	.29	.024	27	.08	.007
10	.29	.024	27	.65	.054
11	.29	.024	28	.08	.007
			28	.65	.054 4/ 5/

1/ High Plains
2/ Loessial Hills (Arkansas)
3/ Loessial Terraces (Arkansas)
4/ Rolling Red Plains
5/ Reddish Prairies
6/ West Cross Timbers
7/ Ozark Highlands
8/ Ouachita Highlands
9/ East Texas Timberlands (Texas)
Forested Coastal Plain (La.-Ark.-Okla.)
* Based on 10% slope; 72 feet slope length, 1.375 inches P_{30} 2-yr. frequency rainfall, 100% row crop cultivated down hill.

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Table 2

COVER ADJUSTMENT FACTORS – CROPLAND

Based on Following Relative Erosion Rates: Row Crop 1.00
Small Grain .30
Hay-Pasture .10

Percent Small Grains - Fall Planted (Read down)

Row Crop Percent	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
0	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	.30
5	.15	.16	.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	.30	.31	.32	.33	.34	
10	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	.30	.31	.32	.33	.34	.35	.36	.37		
15	.24	.25	.26	.27	.28	.29	.30	.31	.32	.33	.34	.35	.36	.37	.38	.39	.40	.41		1.00	100
20	.28	.29	.30	.31	.32	.33	.34	.35	.36	.37	.38	.39	.40	.41	.42	.43	.44		.98	.96	95
25	.33	.34	.35	.36	.37	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48		.94	.93	.91	90
30	.37	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48	.49	.50	.51		.92	.90	.89	.87	85
35	.42	.43	.44	.45	.46	.47	.48	.49	.50	.51	.52	.53	.54	.55		.88	.87	.85	.84	.82	80
40	.46	.47	.48	.49	.50	.51	.52	.53	.54	.55	.56	.57	.58		.86	.84	.83	.81	.80	.78	75
45	.51	.52	.53	.54	.55	.56	.57	.58	.59	.60	.61	.62		.82	.81	.79	.78	.76	.75	.73	70
50	.55	.56	.57	.58	.59	.60	.61	.62	.63	.64	.65		.79	.78	.77	.75	.74	.72	.71	.69	65
55	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69		.76	.75	.73	.72	.70	.69	.67	.66	.64	60
60	.64	.65	.66	.67	.68	.69	.70	.71	.72		.74	.72	.71	.69	.68	.66	.65	.63	.62	.60	55
65	.69	.70	.71	.72	.73	.74	.75	.76		.70	.69	.67	.66	.64	.63	.61	.60	.58	.57	.55	50
70	.73	.74	.75	.76	.77	.78	.79		.68	.66	.65	.63	.61	.60	.59	.57	.56	.54	.53	.51	45
75	.78	.79	.80	.81	.82	.83		.64	.63	.61	.60	.58	.57	.55	.54	.52	.51	.49	.48	.46	40
80	.82	.83	.84	.85	.86		.61	.60	.59	.57	.56	.54	.53	.51	.50	.48	.47	.45	.44	.42	35
85	.87	.88	.89	.90		.58	.57	.55	.54	.52	.51	.49	.48	.46	.45	.43	.42	.40	.39	.37	30
90	.91	.92	.93		.56	.54	.53	.51	.50	.48	.47	.45	.44	.42	.41	.39	.38	.36	.35	.33	25
95	.96	.97		.52	.51	.49	.48	.46	.45	.43	.42	.40	.39	.37	.36	.34	.33	.31	.30	.28	20
100	1.00		.50	.48	.47	.45	.44	.42	.41	.39	.38	.36	.35	.33	.32	.30	.29	.27	.26	.24	15
		.46	.45	.43	.42	.40	.39	.37	.36	.34	.33	.31	.30	.28	.27	.25	.24	.22	.21	.19	10
	.44	.42	.41	.39	.38	.36	.35	.33	.32	.30	.29	.27	.26	.24	.23	.21	.20	.18	.17	.15	5
.40	.39	.37	.36	.34	.33	.31	.30	.28	.27	.25	.24	.22	.21	.19	.18	.16	.15	.13	.12	.10	0
100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	% Row Crop

Percent Small Grains (Spring Planted) Read Up

Based on Following Relative Erosion Rates - Row Crop = 1.00; Small Grains = .40; Hay & Pasture = .10

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Table 3

Relative Rates of Erosion Under Various Types of Cover and Cover Conditions

Type and Cover Condition	Percent of Row Crop Erosion Rate
Row Crop	100 1/
Small Grains (Fall Planted)	30 1/
Small Grains (Spring Planted)	40 1/
Rotation Hay and Pasture	10 1/
Pasture Excellent Cover	1 2/
Pasture Good Cover	10 2/
Pasture Fair Cover	20 2/
Pasture Poor Cover	30 2/
Pasture Very Poor Cover (Stomp Lots, etc.)	50 2/
Woods Poor Cover	15 1/
Woods Fair Cover	10 1/
Woods Good Cover	.01 1/

Reference:

1/ Time Table Study, June 1949

2/ Estimated

COVER DENSITY GUIDE

Cover Condition	Ground Cover Including Litter (%)
Excellent	90 - 100
Good	70 - 89
Fair	50 - 69
Poor	30 - 49
Very Poor	15 - 29

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Table 4

ADJUSTMENT FACTORS FOR SLOPE PERCENT AND SLOPE LENGTH

Percent Slope	Slope Length Feet																								
	40	50	60	72.6	80	90	100	120	140	160	180	200	220	240	260	280	300	350	400	500	600	700	800	900	1000
.5	.015	.016	.017	.019	.019	.020	.021	.022	.024	.025	.026	.027	.028	.029	.029	.030	.031	.032	.034	.037	.039	.042	.044	.046	.048
1.	.036	.039	.042	.045	.046	.048	.050	.053	.056	.059	.061	.063	.066	.068	.070	.072	.073	.077	.081	.089	.094	.099	.104	.109	.113
2.	.092	.100	.107	.115	.118	.124	.128	.137	.145	.150	.157	.162	.170	.173	.178	.184	.187	.197	.207	.228	.239	.253	.266	.278	.289
3.	.153	.167	.178	.192	.197	.207	.215	.228	.242	.251	.263	.270	.284	.290	.297	.307	.313	.330	.345	.380	.394	.422	.443	.465	.482
4.	.228	.248	.265	.285	.293	.308	.319	.339	.359	.373	.390	.402	.422	.430	.442	.456	.464	.490	.513	.564	.593	.627	.658	.690	.715
5.	.309	.336	.359	.378	.386	.417	.432	.459	.486	.506	.529	.544	.571	.582	.598	.618	.629	.664	.695	.764	.803	.847	.892	.934	.969
6.	.396	.432	.462	.497	.512	.537	.557	.591	.626	.651	.681	.701	.735	.750	.770	.795	.810	.855	.895	.984	1.034	1.093	1.148	1.203	1.247
7.	.489	.531	.568	.611	.629	.660	.684	.727	.770	.800	.837	.861	.904	.923	.947	.977	.996	1.051	1.100	1.210	1.271	1.344	1.411	1.479	1.534
8.	.585	.636	.680	.731	.753	.789	.819	.870	.921	.957	1.001	1.031	1.082	1.104	1.133	1.169	1.191	1.257	1.316	1.447	1.520	1.608	1.689	1.769	1.835
9.	.683	.743	.794	.854	.879	.922	.956	1.016	1.102	1.136	1.170	1.204	1.264	1.289	1.324	1.366	1.392	1.469	1.537	1.691	1.776	1.879	1.973	2.067	2.143
10.	.800	.870	.930	1.000	1.030	1.080	1.120	1.190	1.260	1.310	1.370	1.410	1.480	1.510	1.550	1.600	1.630	1.720	1.800	1.980	2.080	2.200	2.310	2.420	2.510
11.	.898	.977	1.044	1.123	1.157	1.213	1.258	1.336	1.415	1.471	1.538	1.583	1.662	1.696	1.741	1.797	1.830	1.931	2.021	2.223	2.336	2.471	2.594	2.716	2.819
12.	1.009	1.098	1.174	1.262	1.300	1.363	1.413	1.502	1.590	1.653	1.729	1.779	1.868	1.906	1.956	2.019	2.057	2.171	2.272	2.499	2.625	2.776	2.915	3.054	3.168
13.	1.132	1.231	1.316	1.415	1.457	1.528	1.585	1.684	1.783	1.854	1.938	1.995													
14.	1.255	1.365	1.459	1.569	1.616	1.694	1.757	1.867	1.977	2.055	2.149	2.212													
15.	1.378	1.499	1.602	1.723	1.775	1.861	1.930	2.050	2.171	2.257	2.360	2.429													

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Table 5 - SAMPLE SHEET EROSION CALCULATIONS

SITE NO. 10 RIVER BASIN: Trinity COUNTY: Hill ACRES: 960 DATE

WATERSHED: Elm Creek LAND RESOURCE AREA: Blackland Prairie AV. P_{30} RAINFALL: SQ. MI. 1.5 COMPUTER

BASIC DATA											SHEET EROSION COMPUTATIONS					
	Land Slope			LAND USE								ADJUSTMENT FACTORS				
				CULTIVATED			Rangeland or Woodland Av. Cover Condition*									
Soil Unit	Gradient	Length	Type of Treatment	Row Crop	Small Grains (F) Fall Pltd. (S) Spg. Pltd.	Hay, Pasture, or Cover Crop	E-G	F	P	Acres	Basic Erosion Rate by Soil Unit (Table 1)	Slope Percent & Length (Table 2)	Cover (Table 3 Cult.) (Table 4 Range & Woodland)	P_{30} Rainfall (Fig. 1)	Av. An. Sheet Erosion Rate Product of Col. 10, 11, 12, & 13	Av. An. Sheet Erosion (Product of Col. 9 & 14 ÷ 12 inches)
	(%)	(Ft.)		(%)	(%)	(%)	(%)	(%)	(%)		(Inches)	(Factor)	(Factor)	(Factor)	(Inches)	(Ac.-Ft.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)
2	3	300	None	100	-	-	-	-	-	100	.54	.313	1.00	1.300	.2197	1.83
2	3	80	Terraced	100	-	-	-	-	-	300	.54	.197	1.00	1.300	.1373	1.15
2	3	300	None	-	F (100)	-	-	-	-	400	.54	.313	.30	1.300	.066	2.20
2	4	100	None	-	-	-	-	100	-	160	.54	.319	.10	1.300	.022	.29
															Total	5.47 1/

*Cover Condition Class: E-G = Excellent-Good F = Fair P = Poor

1/ May be converted to tons by applying appropriate cubic-foot dry weight value.

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Table 6

ANNUAL CHANNEL EROSION

SITE NO. 10 WATERSHED Elm Creek COUNTY Hill ACRES 960 SQ. MILES 1.5

LAND RESOURCE AREA: Blackland Prairie RIVER BASIN Trinity DATE

1						2	3	4	5	
TYPE OF EROSION						LENGTH AFFECTED	AV. HT. OF BANK OR WIDTH OF CHANNEL	LATERAL OR VERTICAL CUTTING RATE	VOLUME OF ERODED MATERIAL (Product of Col. 2, 3, & 4)	
GULLIES			OVERFALLS OR HEADCUTS	CHANNEL ENTRENCH-MENT	STREAM-BANK					
Modern	Ancient	Roadside				(Ft.)	(Ft.)	(Ft.)	(Cu. Ft.)	(Ac. Ft.)
X						900	4	.20	720	.0165
		X				1500	3	.10	450	.0103
					X	1800	5	.10	900	.0207
								TOTAL	2,070[1/]	.0475[1/]

1/ May be converted to tons by applying appropriate cubic-foot dry weight value.

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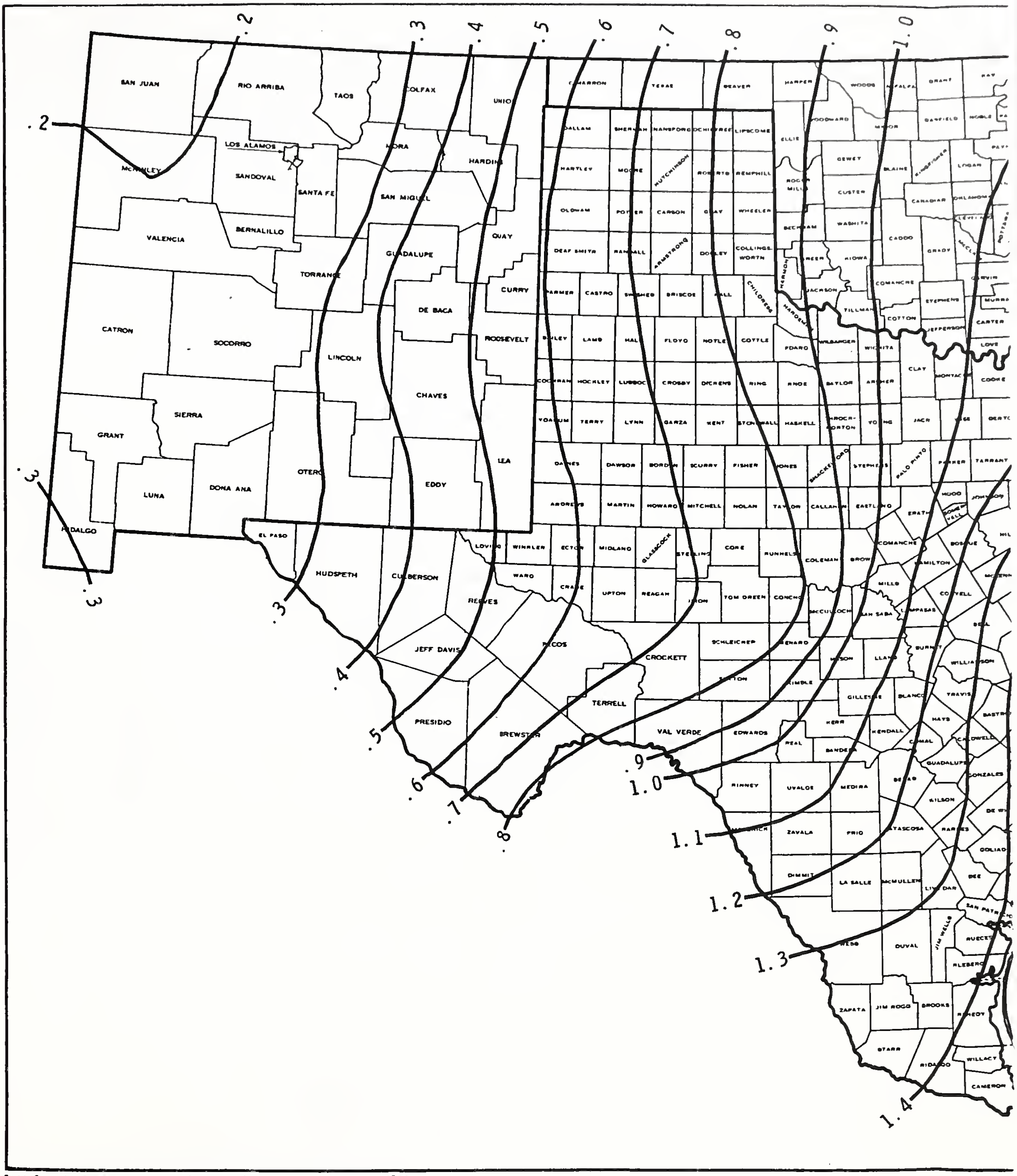

BASE FROM U. S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS - 1952

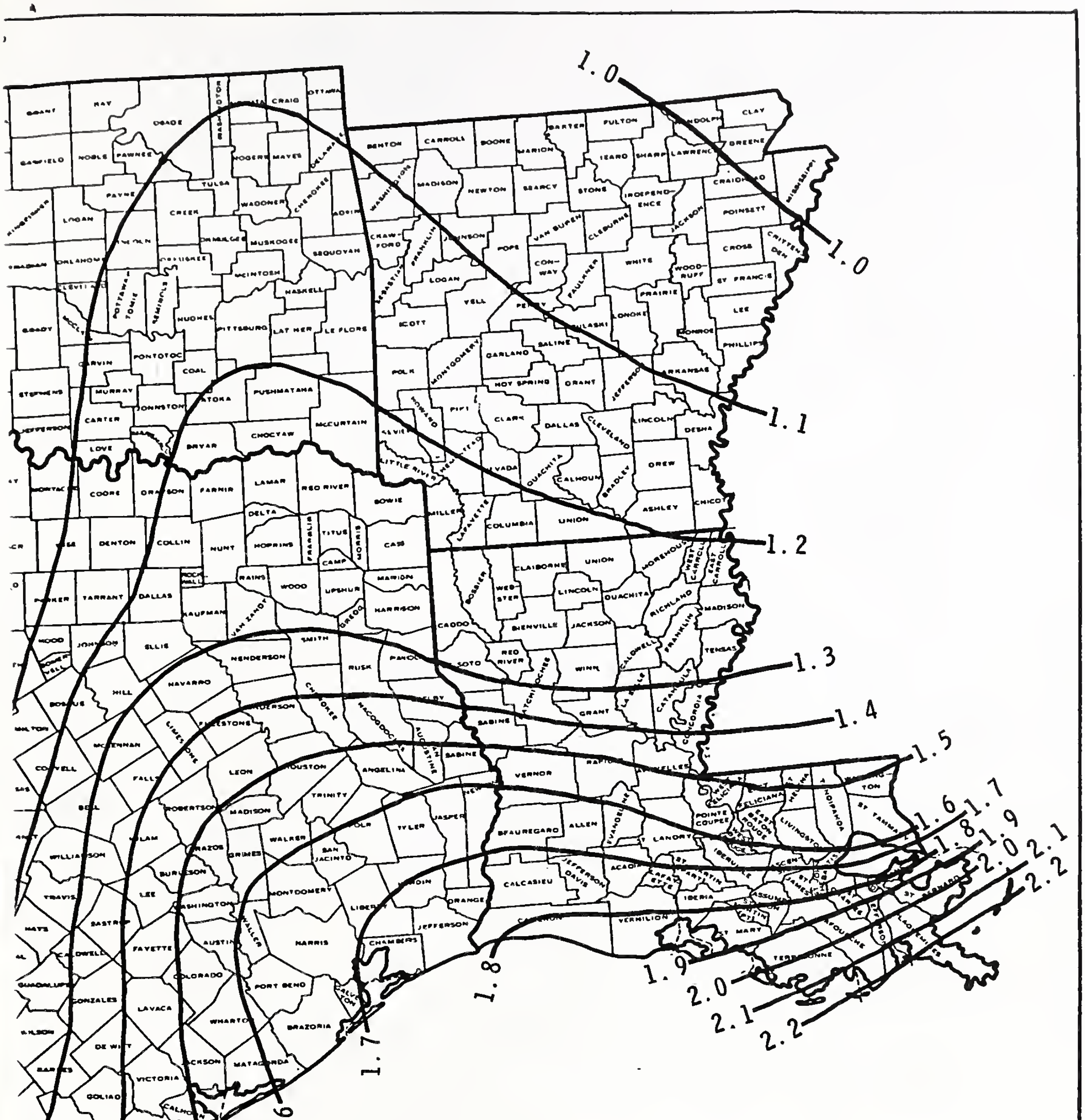

Figure 1

RAINFALL ADJUSTMENT FACTORS
Based on Maximum 30-Minute Rainfall
Two-Year Frequency
ARKANSAS, LOUISIANA, NEW MEXICO,
OKLAHOMA AND TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FORT WORTH, TEXAS

REFERENCE

CARTOGRAPHIC APPROVAL   TECHNICAL APPROVAL

COMPILED   TRACED   CHECKED   DATE

Ref.: Technical Paper No. 40, Weather Bureau

Rev. 10-61   4-R-10521

10-12-56   Base 4-R-10919